

## **White Paper: ISMS and Chemical Safety**

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### **Introduction**

Integrated Safety Management (ISM) includes the concept of a safety authorization basis – the basis on which DOE relies to assure that the public, workers, and the environment are provided an adequate level of safety. Currently approved DOE directives relating to chemical safety do not provide a complete framework for a hazardous chemical facility safety basis. The purposes of this White Paper are to review the relationship of ISM to safety regulations and DOE directives; to examine the scope of the regulations and directives relative to the establishment of hazardous chemical facility safety bases to show where gaps exist in the framework; and to explain how the proposed new Hazardous Chemical Facility Safety Basis directive could complete the framework.

### **Integrated Safety Management**

An Integrated Safety Management System (ISMS) is a total management system that mandates the incorporation of safety and environmental considerations into the process of defining, planning, and executing work. When work is planned, it must include the elements necessary to provide for adequate safety of the public, workers, and the environment. These safety elements must be budgeted and implemented.

The five core functions of an ISMS are: 1) define the scope of work, 2) analyze hazards 3) identify controls, 4) perform work in accordance with the controls, and 5) feedback and improvement. These functions are applicable on three levels that may be involved with any work: task level, facility level, and site level. The relationships of these functions and levels are conceptually shown in the so-called Los Alamos Prayer Wheel (see Attachment 1).

A completely ISM System-compliant safety strategy deals with all aspects of safety, including industrial safety, industrial hygiene, fire safety, electrical safety, chemical safety, nuclear safety, and so on, at each level. In order to be ISM-system compliant, a facility that contains many different types of hazards must deal with all of them in a systematic way and at each level. The specific safety strategy for a hazardous facility is called its safety basis. A contractor's commitment to facility operations in accordance with its documented safety basis is DOE's assurance that work can and will be conducted safely.

The ISMS core functions that are key for developing a safety basis are analyzing hazards and identifying controls. When describing an ISMS contractors must define how these functions will be accomplished. Within DOE, this is most often done by designating regulations and DOE Orders that deal with these functions that will be complied with and the flow-down of implementing standards and procedures that provide more detail on how the Orders will be implemented on the working level. This flow down starts with Lists A and B of their contracts (required by the Department of Energy Acquisition Regulations (DEAR clauses)), which are listings of regulations and laws (List A) and DOE Orders and Standards (List B) that they will comply with in performing of their work.

DOE P 450.4, Safety Management System Policy and certain clauses within the DEAR invoke ISMS. The Policy describes Integrated Safety Management and makes it a policy that ISMS will be implemented for all DOE work. The DEAR clauses require DOE Contracting Officers to insert in contracts a requirement for contractors to develop and implement an ISMS for their work.

### **Chemical Facility Safety**

Components of a safety management system focused on hazardous chemicals and chemical processes include standard operating procedures (SOPs) for normal and off-normal operational conditions; a work authorization system for non-routine work; and consideration of major accident potentials with the goals of prevention and/or mitigation. Other components include process safety information, a pre-startup safety review process, a mechanical integrity program with a management of change process, training programs, emergency preparedness, and an audit process. Three of these components involve the ISMS core functions of analyzing hazards and identifying controls. They are SOPs for normal and off-normal (and sometimes emergency) operations, the analysis of hazards and controls for non-routine work, and consideration of major accident potentials.

An assessment of the regulations and Orders that are relevant to the ISMS core functions of analyzing hazards and identifying controls for hazardous chemical facilities follows.

Operational safety for normal and off-normal conditions. Operational safety is generally maintained through the use of SOPs for normal and off-normal (and sometimes emergency) conditions. Operational safety is directed toward protection of workers and minimization of off-normal (anticipated upset) conditions, and toward ensuring that operations remain within specified (design) parameters. It is concerned with the maintenance of controls to limit worker exposure and controls to stabilize minor upsets and off-normal conditions. Management of normal operations and off-normal conditions involves considerations for design such that, for example, emissions are controlled; air monitoring is provided as needed; ventilation is adequate; and hazards analyses are completed for deviations from design intents.

DOE O 440.1 addresses safety management for normal operations and off-normal conditions primarily in Sections 4.i and 4.j of the Order and in its Guide, DOE G 440.1-1, Sections 4.3 and 4.4.

Non-routine work. The safety of non-routine work, or short-term tasks, is generally maintained through the use of a work authorization system, rather than through SOPs. The safety of non-routine work is also directed primarily toward protection of workers, often, but not always, maintenance workers. It is addressed using such methods as job task analysis or job hazards analysis. When short-term, non-routine work is undertaken, job hazards analyses or job task analyses are performed to identify hazards and appropriate controls to protect workers performing that work. These analyses typically consider what can go wrong, how to prevent it, and what industrial hygiene or safety measures are needed for worker protection, for example, personal protective equipment (PPE).

Short-term, non-routine work is also addressed in DOE O 440.1 and its Guide, in the Sections quoted above.

Consideration of major accident potentials. At the facility level, the focus of safety concerns is with potential major equipment or structural failures, for example vessel ruptures, within a facility that could be caused by events such as human error, fires, explosions, severe weather, or seismic phenomena. During the design of new facilities, preliminary (engineering) hazards analyses are used to identify potential accident scenarios. Designs are guided by these analyses, as necessary, to eliminate the potential for some accidents or to reduce either the likelihood or the severity of the consequences of others. Sometimes facility designs can be modified to increase inherent safety. For example, using non-combustible materials of construction makes a facility inherently safer from fires. Eliminating asbestos from materials of construction makes a facility safer for workers who might come into contact with the asbestos in air-borne form. Although facility designs to provide for inherent safety are preferred, they are not always possible. Under these circumstances, engineered safety systems, for example, fire protection systems, can be added to increase facility safety.

The canceled DOE Order 5481.1B addressed consideration of major accident potentials for low, medium, and high hazard facilities. The Occupational Safety and Health Administration (OSHA) rule on process safety management (PSM), 29 CFR 1910.119, and the Environmental Protection Agency (EPA) rule on risk management plans (RMP), 40 CFR Part 68, also address facility-level, as well as site-level, safety. However, thresholds for the applicability of these regulations are generally regarded as fairly high, in terms of hazardous chemical inventories found at most DOE sites. And, with respect to worker safety, the level of hazard posed by these threshold chemical quantities is very high.

The proposed Hazardous Chemical Facility Safety Basis directive (see Attachment 2) is intended to replace the canceled DOE Order 5481.1B. For facilities that contain hazardous chemicals in excess of specified threshold quantities, it requires contractors to address the potential for major accidents and the controls in place to prevent such accidents and/or to mitigate their consequences. It also provides a framework for documenting the full safety basis of a hazardous chemical facility, including commitments to the applicable provisions of DOE Order 440.1 and to appropriate chemical safety management programs.

The draft "Chemical Management System Guide," 28 September 1998, prepared by Billy Lee, EH-52 describes the integration of task, facility, and site management of chemicals. It addresses both normal operations and non-routine work. It includes inventory tracking and control of chemicals, identification and analysis of chemical hazards (on the task level), management of change, and emergency planning and response. Except for emergency planning and

response, however, the guide focuses primarily on normal operations and minor upsets, and chemical hazards at the task level. Nonetheless, it is a good start at an implementation guide for chemical safety management within DOE. It could be augmented to provide the more detailed guidance for the proposed directive to formulate a facility safety basis.

## **Conclusions**

As stated in the Introduction to this paper, ISM includes the concept of a safety authorization basis – the basis on which DOE relies to assure that the public, workers, and the environment are provided an adequate level of safety when it authorizes operations of its hazardous facilities. Such a safety authorization basis for hazardous chemical facilities would include all of the elements discussed in this Paper. In some cases, these and other elements (such as conformance with EPA regulations, etc.) are formalized in an Authorization Agreement, signed by representatives of DOE and the operating contractor.

There is no current DOE directive that requires the documentation of the safety basis for non-nuclear hazardous DOE facilities. The core functions of ISMS require that the activities of analyzing hazards and identifying controls be accomplished, but the concept of an ISMS provides only a framework, which needs to be built upon to describe how these functions are to be accomplished. The structure includes the Lists A and B of the contract and the flow down of implementing procedures. The proposed Hazardous Chemical Facility Safety Basis directive is intended to provide a DOE driver (List B component) that can be referenced as the standard for documenting the safety basis of hazardous chemical facilities, including commitments to the applicable provisions of Order 440.1, chemical safety management programs, and any other appropriate component necessary to provide a basis for protection of the public, workers, and the environment. Such documentation can serve as the safety authorization basis from DOE to the operating contractor and the standards by which the contractor commits to operate the facility.